1982

Decreasing the Postcalving Anestrous Period in Suckled Beef Heifers

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DECREASING THE POSTCALVING ANESTROUS PERIOD IN SUCKLED BEEF HEIFERS

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Summary

The interval from calving to first ovulation was reduced to less than 45 days in 2-year-old suckled heifers by feeding a high energy diet (ADG, 1.4-2.5 lb/day) during the postcalving period or by a single injection of exogenous gonadotropin (2,250 IU PMSG) on day 42 postcalving. A comparison of reproductive parameters for heifers on the high and low energy (maintenance) diets during the postcalving period indicated that a higher percentage of heifers on the high energy diet had ovulated by 46 days post/calving (100 vs 0 %) and that both basal plasma luteinizing hormone (LH) concentration and estrogen-mediated LH release was increased during the early postcalving period. Results of these experiments suggest that the level of endogenous gonadotropin secretion may determine the length of the postcalving anestrous period and that plasma LH may be a useful parameter in establishing nutrition requirements for the postpartum lactating cow.

Introduction

Duration of the postcalving anestrous period can be influenced by lactation, nutrition, age of cow, breed of cattle, or a combination of these factors. The described experiments were conducted to determine how these factors affect ovarian and pituitary activity in the 2-year-old suckled heifer.

Procedure

Experiment 1: Two-year-old suckled Angus and Brown Swiss heifers, 12 of each breed, were treated with 750 or 2,250 IU of pregnant mare serum gonadotropin (PMSG) at 42 days postcalving to determine (1) cause(s) of previously observed breed differences in duration of the postcalving anestrous period, and (2) the relationship between postcalving reproduction and level of milk production. Peripheral blood samples were collected at 6-hr intervals for LH and estrogen and progesterone measurements to assess pituitary and ovarian response respectively. Daily milk production for each cow was estimated at 34, 40, and 60 days postcalving by the calf-weight change technique.

The relationship among dietary energy intake, ovarian follicular development, and ovarian and pituitary hormone secretion, during the postcalving period, was evaluated in 36 first calf Hereford heifers (Experiment 2). Sixteen of the heifers received a high energy diet (corn, corn silage, and soybean meal) during the precalving (last trimester) and postcalving period (approximate ADG 2.6 lb/day precalving and 1.6 lb/day postcalving), whereas the remaining 20 heifers received a maintenance ration. Peripheral blood samples were collected at 3-day intervals for LH, follicle stimulating hormone, prolactin, estrogen, and progesterone measurements. Heifers from both diets (4 high and 5 low) were ovariectomized at 10, 28, 46, and 70 days postcalving to evaluate follicular development and the occurrance of ovulation.

Results

The administration of 2,250 IU PMSG induced ovulation in all 12 heifers, whereas 8 of 12 heifers receiving 750 IU PMSG had ovulated within 10 days after the injection (Table 1). A breed comparison indicated that Brown Swiss produced more milk (mean overall difference, 4.9 lb/day) and had a longer interval from injection of 2,250 IU PMSG to occurrance of the preovulatory LH surge than Angus, which may indicate a negative relationship between milk production and pituitary responsiveness. Both breeds had increased ovarian and pituitary stimulation with 2,250 IU PMSG as compared with 750 IU.

Initiating reproduction cycles in the suckled Hereford heifers (Experiment 2) was influenced by dietary energy intake as 100% of the heifers on the high energy diet had ovulation by 46 days postcalving, whereas on the low energy diet (maintenance) 20% ovulated in the day 28 postcalving group, none in the day 46 group, and 40% in the day 70 group (Table 2). However, gross observations of follicular development at ovariectomy did not reveal a difference in the number of follicles (grouped by size) or in mean ovarian weights. A comparison of plasma LH concentrations and estrogen-mediated LH surges between the two dietary groups indicated that the heifers on the high energy diet had increased basal plasma LH concentrations (3.3 vs 2.4 ng LH/ml plasma). Additional hormone analyses of blood and follicular fluid samples are in progress. Calf birth weight tended to be increased by the higher energy precalving diet (68 vs 63 lb).

Results from these two experiments suggest that length of the interval from calving to first ovulation is inversely related to level of endogenous gonadotropin stimulation. Therefore, increased dietary energy intake increases basel LH secretion which, in turn, enhances ovarian and pituitary hormone secretion and the spontaneous induction of ovulation. Additional experiments are being planned to further evaluate the relationship between nutrition and postpartum reproduction.

Table 1.—Ovarian and pituitary response to PMSG in anestrous cows at 42 days postpartum

Treatment[1]	Number ovulating	Interval from PMSG to LH surge (hours)	Maximum preovultory e_2 concentration (pg/ml)
750 IU of PMSG:			
Angus	3	[2] 82.0 ± 12.2	[2 3] 8.7 ± 1.3
Brown Swiss	5	[2] 69.6 ± 7.0	[2 3] 8.3 ± 1.5
Mean		[2] 74.3 ± 6.2	[2 3] 8.4 ± 1.0
2,250 IU of PMSG:			
Angus	6	[3] 55.0 ± 3.9	[2] 8.6 ± .7
Brown Swiss	6	[2] 68.0 ± 4.0	[3] 12.1 ± 1.3
Mean		[2 3] 61.5 ± 3.3	[2 3] 10.4 ± .9

[1]Each treatment group contained 6 cows. Time interval between LH surge and ovulation is approximately 24 h.
[2 3]Significance with a column at $P<0.05$.

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Table 2.—Effect of dietary energy on postpartum reproduction in beef heifers

Time of ovariectomy	Number of cows	Number ovulating	Basal LH concentration (ng/ml)	Estrogen-mediated LH surge (ng/ml)
Day 10 postpartum:				
Low energy diet	5	0	2.3	32.8
High energy diet	4	0	3.3	53.9
Day 28 postpartum:				
Low energy diet	5	1	2.0	66.5
High energy diet	4	0	2.9	93.0
Day 46 postpartum:				
Low energy diet	5	0	2.2	58.7
High energy diet	4	4	3.7	109.2
Day 70 postpartum:				
Low energy diet	5	2	3.1	74.5
High energy diet	4	4	3.4	109.2
Overall:				
Low energy diet	20	3	2.4	58.1
High energy diet	16	8	3.3	90.1